Fire History Assessment for the Lolo Trail
Powell Ranger District, Clearwater National Forest

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INTRODUCTION

For untold centuries before 1900, the Lolo Trail was a notoriously difficult route across northern Idaho's Bitterroot Mountains. In fact, this approximately 150-mile mountain traverse was by far the most dreaded segment of the several thousand mile Lewis and Clark Expedition of 1804-1806 (DeVoto 1953). A number of environmental factors--steep, highly dissected terrain, dense forests, weather, lack of game-- made early-day travel along the Lolo Trail a daunting experience. This portion of the mountains is drained by deep stream canyons in a complex dendritic pattern and, while most of the Lolo Trail traverses high ridges, some trail segments lose and regain several thousand vertical feet in just a few miles. Worse, the area's lush, often impenetrable forests periodically are destroyed by intense forest fires, producing heavy snagfalls. Clearly, foot travel along this ancient trail was far more arduous than in the broad intermountain valleys that Lewis and Clark had encountered elsewhere in the Northern Rockies.

Today, recreationists and students of cultural history can drive much of the Lolo Trail, seeking a vignette of Lewis and Clark's journey. Post-1900 fires and modern management have eliminated much of the primeval forest along the trail, but tree ring research can be used to interpret the forest conditions that existed during various times. In 1995, fire history sampling was conducted along the Lolo Trail in Powell Ranger District, Clearwater National Forest (CNF). The goal was to document long-term fire history as a primary basis for interpreting past- and current forest environments near the trail. Such information might be useful for interpreting the area's cultural history, and would provide fire regimes data for ecosystem management.

RESULTS AND DISCUSSION

Landscape Fire History. Sampling and forest age class mapping was completed for an approximately 50-mile long, square-mile wide zone bisected by the Lolo Trail. Fire scar- and forest age class data were obtained from 67 plots (Arno and Sneck 1977, Barrett and Arno 1988), including at 13 historic sites visited by the Lewis and Clark Expedition (1805-06), Nez Perce Chief Joseph and U.S. Army General Howard (1877), and the John Work Party (1831). In Powell District, about two-thirds of the Lolo Trail passes through subalpine forests and meadows, and the remaining third passes through montane- and riparian forests at low elevations. Fire scar- and pith samples were obtained from old growth stands dominated by lodgepole pine (*Pinus contorta*) and/or western larch (*Larix occidentalis*), and from stands of mixed conifers such as larch, Douglas-fir (*Pseudotsuga menziesii* var. *glauca*), grand fir (*Abies grandis*), subalpine fir (*A. lasiocarpa*), western redcedar (*Thuja plicata*), and western white pine (*Pinus monticola*). Nearly pure stands of mountain hemlock (*Tsuga heterophylla*) occupy north aspects at high elevations (e.g., 6000-7000 ft), but the ancient trail usually traversed the more easily traveled south sides of ridges, where less dense stands of lodgepole pine and beargrass (*Xerophyllum tenax*) are interspersed with grassy glades and rock outcrops.

Northern Idaho in general has a very notorious recent fire history (Larsen 1929, Koch [undated], Barrett 1982, Barrett 1995). For example, hundreds of thousands of acres of forest were destroyed by extensive fires during droughts in 1889, 1910, 1919, and 1934 (Barrett 1995). It can be challenging to determine long-term fire history in many locales, but most areas contain some remnant old growth, or at least scattered fire-scarred veterans and well-preserved snags. In Powell District, an estimated 90 percent of the forest along the trail occurs in the stand

replacement fire regime. Scarred trees typically are rare, and fire history is interpreted largely from age class analysis. The remaining 10 percent is in the mixed severity fire regime, for example, dry south-facing stands at low elevations in the Lochsa River canyon. These stands contain a few fire-scarred western larch, ponderosa pine, and redcedar, but the trees rarely survive more than one or two events before succumbing to relatively severe fires. Historically, lightning probably caused most fires in these mountains, because Indian burning occurred primarily in valley grasslands and adjacent dry forests (Barrett and Arno 1982).

Fire history was documented back to ca.1510. The master fire chronology (Appendix) contains an estimated 22 fires between ca.1510 and 1960, yielding an area mean fire interval (MFI) of 21 years. That is, fires occurred somewhere in the nearly 50-mile long trail corridor at least every two decades, on average. But when fire frequency is based on the most complete data (ca.1657-1929), area MFI equals about 17 years. Evidence of long-term fire history is now fragmentary for considerable portions of the trail corridor, but 6 or 7 fires apparently produced the bulk of today's age class mosaic. This yields an area MFI of about 70 years between important stand replacing events (ca. 1510-1929).

The fire frequency curve is highly skewed in time. For example, fires were very active throughout the 1700s, when area MFI was just 11 years. The mean interval was about 30 years during the 1800s, at the height of the cool-moist Little Ice Age. These fire patterns near the Lolo Trail would have great significance for the Lewis and Clark Expedition, and for Chief Joseph's historic crossing in 1877 (discussed below). Subsequent fires between 1910 and 1929 burned large portions of the area, and no important fires have occurred since then. Before about 1930, actual intervals between fires in the corridor ranged from about 3 years to 43 years long, but

were usually between 10 and 20 years long. Importantly, today's 7-decade fire-free interval is unprecedented since at least the mid-1600s, and is 4 times longer than the pre-1929 MFI of 17 years. Moreover, the current interval now equals the historic mean for major fires.

The forest age class map (enclosed with this report) provides new perspective on some of the hardships endured by early-day travelers. For example, mapping for subalpine portions of the trail (e.g., Papoose Saddle to Saddle Camp) was often difficult because ridge lines can contain multiple intersecting burn margins from fires on opposite sides of the ridge. The ancient trail therefore passed through a constantly changing forest mosaic, often tangled by downed snags. Immature stands (e.g., <30 yr) probably were the most difficult to penetrate, because of the combination of dense regeneration and heavy initial snagfall.

Following is a coarse-scale description of today's major fire-regenerated age classes from east to west along the Lolo Trail. Three classes (ca.1733, 1784, 1810 fires) dominate the 12-mile segment from Packer Meadows to Powell Island, and the 13-mile segment between 21-Mile Camp and Snowbank Camp. Decades of heavy logging in the Crooked Fork drainage have depleted area old growth, but this portion of the trail contains 3 of the oldest age classes in the master fire chronology (ca.1510, 1571, 1733). In 1805, therefore, the steep upper Lochsa drainage contained a highly variable mosaic of stands ranging in age from just 20 years to 300 years or more. Lewis and Clark's party clearly became very discouraged in the Bitterroot Mountains after comparatively easy going during the previous few weeks. Captain Clark's journal of September 14, 1805 verifies that the trail to Powell Island was much more difficult than in the open lodgepole pine stands east of Packer Meadows:

> "*In the valies it rained and hailed, on the top of the mountains Some Snow fell...The mountains which we passed to day much worst than yesterday* (i.e. in present-day

Montana) *the last excessively bad & thickly Strowed with falling timber & Pine Spruce fur Hackmatak & Tamerack, Steep & Stoney...our men and horses much fatigued, ...*" (DeVoto 1953: 239).

Ironically, a very large forest fire occurred shortly after Lewis and Clark passed through this area. The age class map suggests that a ca.1810 age class currently dominates the forest for at least 15 air miles between Brushy Fork and Squaw Creek. The outcome of the expedition conceivably could have been much different had this fire occurred a few years earlier--faced with a vast and impenetrable recent burn, the explorers would have been forced to drastically alter or abandon their route, as had occurred 3 weeks earlier in the Salmon River canyon.

At least five days were required to cross the Bitterroots on the Lolo Trail. Throughout this time the Lewis and Clark Expedition was repeatedly hampered by windfalls, largely fire-killed snags. For instance, numerous detours on September 19th, 1805, forced the party to travel nearly twice the direct distance of the trail near Hungery Creek (west of the Powell District boundary). Clark had written the following after climbing Wendover Ridge on September 15th:

"...here the road leaves the river to the left and assends a mountain winding in every direction to get up the Steep assents & to pass the emence quantity of falling timber which had [been] falling from dift. causes i e fire & wind and has deprived the greater part of the Southerly sides of the mountain of its green timber, ...after two hours delay we proceeded on up the mountain Steep and ruged as usial, more timber near the top ...." (DeVoto 1953: 239).

A mixed mosaic currently occupies unlogged portions of this area, and at least 3 fires in the chronology pre-date the expedition. For example, lower Wendover Ridge burned in ca.1784, evidently producing the tangle of fallen snags and barren slopes described by Clark. The mature timber along upper Wendover Ridge (near Snowbank Camp) apparently had regenerated after fires in ca.1510, 1557, and 1710. The 1810 fire subsequently destroyed most of these stands, but

scattered remnants exist along the upper trail today.

Post-1800 age classes now dominate the south-facing slopes between Snowbank Camp and Indian Post Office, namely, ca.1810, 1861, and 1910. However, older stands of mountain hemlock or mixed conifers still occupy many north slopes in the upper Cayuse drainage, as well as between Lonesome Cove and Gravey Creek (ca.1657 to 1784 regeneration). To the west, extensive stands of 60- to 80 year old lodgepole pines (i.e., 1910, 1919, 1929 fires) blanket the remaining 8 miles of trail between upper Gravey Creek and Powell's western boundary, including at the Sinque Hole and Smoking Place historic sites. Here, only a few fire-scarred veterans and burned snags from the 1657-1784 period provide evidence of an earlier forest.

The data were analyzed in an attempt to reconstruct the age class mosaics that existed in 1805 and 1877 (figs. 1-4). The most important finding is that timber harvesting and effective fire exclusion apparently have substantially reduced landscape diversity when compared with earlier periods. Specifically, the current age classes in the eastern trail corridor are skewed toward either early successional clearcuts or highly fragmented old growth forest (fig. 1). Conversely, the subalpine forest in the middle to western portion is skewed toward mid- to old age classes, and contains no young fire-regenerated stands. Much evidence of pre-1800 stands has been lost over time, but the fire-generated mosaics that existed in 1805 and 1877 apparently were more diverse, both compositionally and geographically (figs. 2-4). Interestingly, many of today's unlogged stands actually might be more navigable on foot than during the 1800s, because overmature stands usually contain more openings, fewer understory trees, and less-dense snagfalls.

Figs. 1-4. Forest age class mosaic for 3 time periods in the Lolo Trail Corridor, Powell Ranger District, Clearwater National Forest. Mean stand ages based on dominant seral classes in consecutive square miles of the corridor (east-to-west, via lower trail loop).

Site Location Code. A: Packer Meadows B: Glade Creek Camp C: Powell Island D:Whitehouse Pond E: Snowbank Camp F: Cayuse Junction G: Bears Oil & Roots H: Indian Post Office /Lonesome Cove I: Howard Camp J: Sinque Hole K: Smoking Place

Fig. 1. Lolo Trail Forest Mosaic: 1995

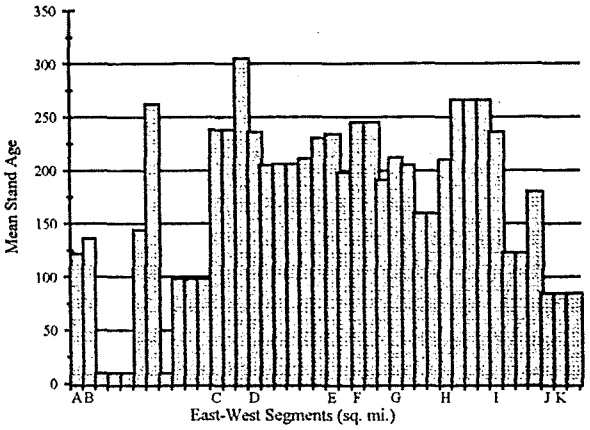


Fig. 2. Lolo Trail Forest Mosaic: 1877

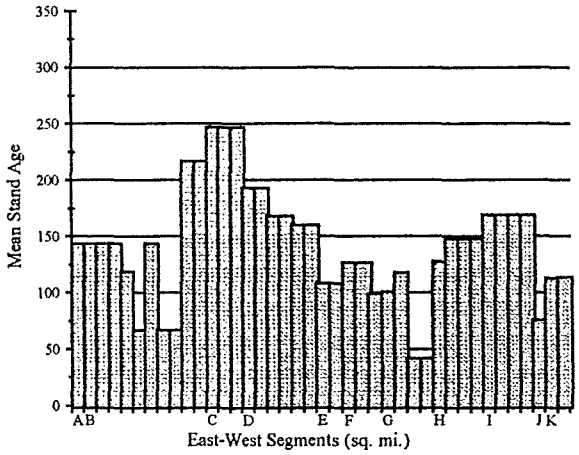


Fig. 3. Lolo Trail Forest Mosaic: 1805

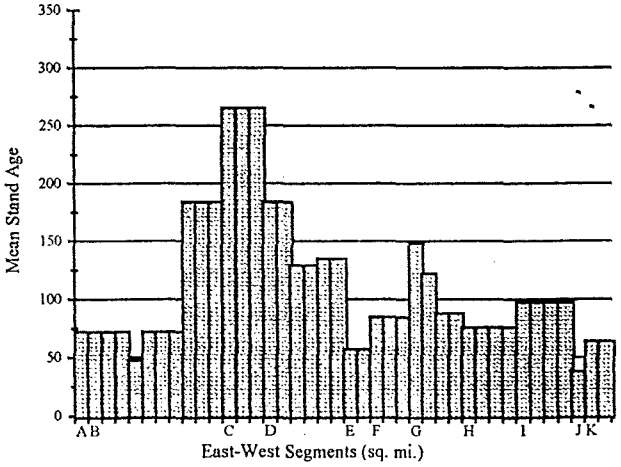
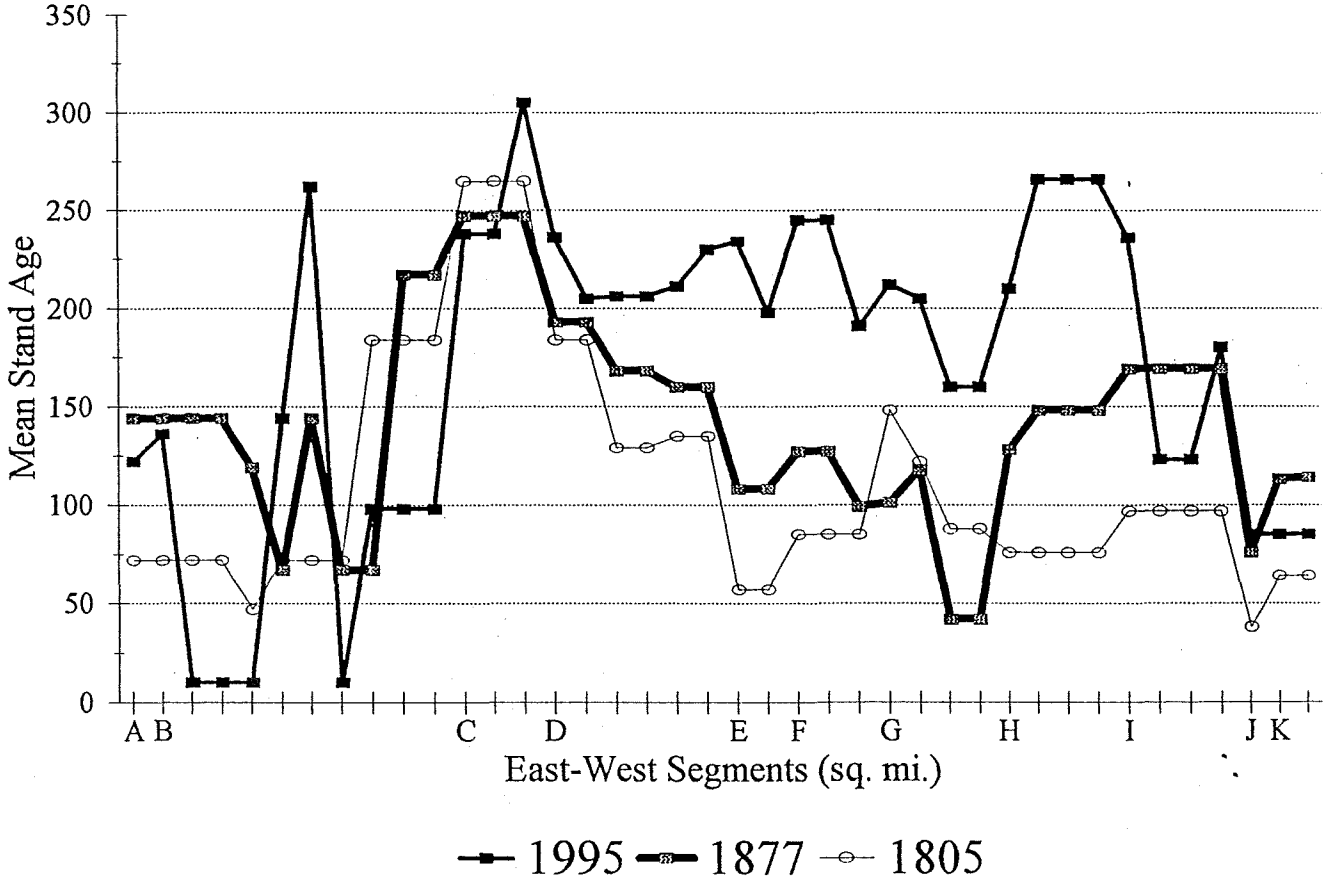


Fig. 4. Lolo Trail Forest Mosaic for 3 Time Periods



On the Lolo Motorway today, one can scarcely appreciate the trials and tribulations endured by earlier travelers. The landscape has changed, but the area still contains many examples of primeval stands--because "primeval" does not necessarily mean "old growth." Indeed, because of the large fires in the 1700s, the Lewis and Clark Expedition had to pass through many young- to mid-age stands (fig. 3). Evidently only the lower trail loop (e.g., near Powell Island) contained much old growth in 1805, that is, larch- and redcedar stands that had arisen after fires in the 1500s and earlier. Conversely, mature lodgepole pine stands occupied much of the subalpine terrain near Packer Meadows, and between Snowbank Camp and the present-day western district boundary. Cross-country travel is often not difficult in mature lodgepole pine stands, as can be seen today near the Sinque Hole and Smoking Place (i.e., 1910 age class).

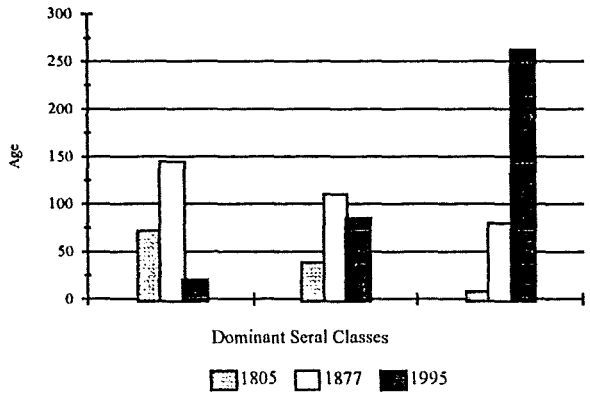
Chief Joseph's crossing of the Lolo Trail in 1877 may have been considerably more difficult by comparison. Besides being a much larger party with numerous horses--and in great haste--the Nez Perce also had to pass through a more diverse age class mosaic (figs. 2-4). By 1877, the largely 1700s-generated mosaic had become increasingly more fragmented by several large fires between ca.1810 and 1861--thus area stands ranged widely in age. Today, the mid- to upper Cayuse drainage provides a fine example of age class diversity, where stands in the mosaic range from 80 to 350 years old. On the other hand, good examples of contiguous old growth can be found between Cayuse Junction and Saddle Camp, and between Powell and Whitehouse Pond. Stands in both areas currently range from 200 to 500 years old.

Site Fire Histories. Fire history also was analyzed for historic sites along the Lolo Trail, for use in interpretive projects and for ecosystem management. Note that these reconstructions apply primarily to general locales, because some of the actual sites no longer contain long-term evidence.

Packer Meadows/Glade Creek Camp. The Lolo Pass area today contains mid- to old age stands of larch-lodgepole pine, lodgepole pine, and spruce-fir, interspersed with moist meadows and clearcuts. Accordingly, the local fire history is complex. Relatively moist stands have a stand replacing regime with relatively long fire intervals, whereas upland dry sites display a mixed severity regime of short- to moderately long fire intervals. Seral dominants near both Packer Meadows and Glade Creek Camp regenerated after a ca.1733 fire. But whereas the riparian spruce-fir stand at Glade Creek has not burned in the past 262 years, the lodgepole pine mosaic near Packer Meadows reburned in ca.1767, 1797, and 1910. MFI for the entire Packer Meadows/Glade Creek basin was 59 years between 1733 and 1910, which was the area's last important fire. The current 85-year long fire interval in the basin is among the longest in the chronology, but timber harvests have largely supplanted fire's role as a predominant disturbance agent.

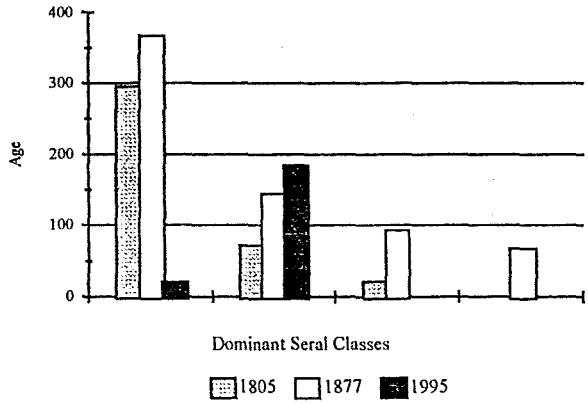
These stands ranged from less than 10 years old to about 72 years old in 1805 (fig. 5), but older trees likely also occupied the drier hillsides. The stands would have been 80- to 150 years old or more in 1877. In either case, however, gentle terrain and the surrounding meadows made this portion of the Lolo Trail far less challenging than areas to the west.

Fig. 5. Forest Age Classes by Period
Packer Meadows/Glade Creek Camp



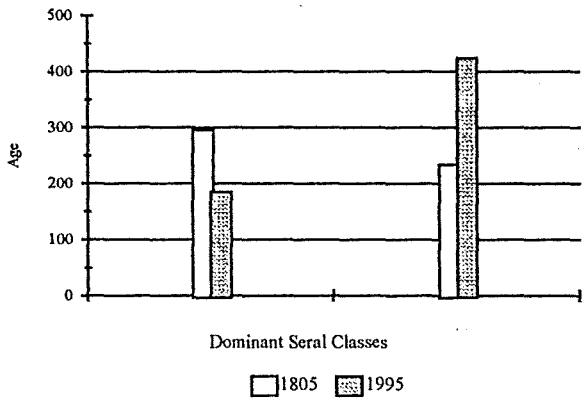
21-Mile Camp/Powell Junction. The few remaining unlogged stands between 21-Mile Camp and Powell Junction today support dense stockings of 185-year larch, mixed conifers, and lodgepole pine. Most of the upper trail loop burned in ca.1810, leaving only scant evidence of prior age classes. But remnant larch in the Crooked Fork drainage near 21-Mile Camp date to ca.1510, 1733, and 1784. Therefore, stands in the 1805 mosaic ranged from less than 20 years old to 300 years old or more (fig. 6). The 1877 mosaic, which ranged from 70 to 400+ years old, also was much more diverse than at present.

Fig. 6. Forest Age Classes by Period
21-Mile Camp/Powell Jct.



Powell Island/Whitehouse Pond. At least 5 miles of the Lochsa canyon bottom, between White Sand Creek and Whitehouse Pond, today displays virtually the same fire history. Most unlogged stands date from the large 1810 fire, but the piths of scattered remnant larch indicate previous stand replacing events in ca.1510 and 1571. This suggests comparatively long stand replacement intervals (e.g., 250-300 yr) can occur in moist bottomland stands. Therefore, Lewis and Clark had passed largely through old growth, not unlike today's stands (fig. 7). This was fortunate, because many surrounding slopes apparently contained heavy snagfalls from a recent fire in ca.1784.

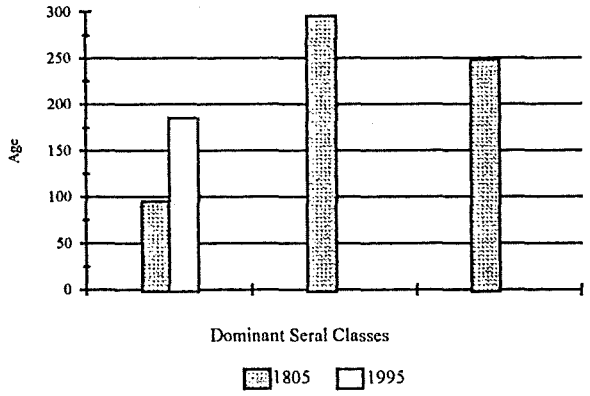
Fig. 7. Forest Age Classes by Period
Powell Island/Whitehouse Pond



Snowbank Camp. The Lewis and Clark Expedition arrived at Snowbank Camp after a tiring and somewhat dangerous 3400 foot vertical climb up 5-mile long Wendover Ridge. (Several horses had been injured during falls, delaying the party, and 2 exhausted animals subsequently were abandoned near Snowbank Camp). Upon reaching the ridge top, however, the party must have had an easier time in the south-facing lodgepole pines. These stands had originated after fires in ca.1710, and perhaps 1510 and 1557, thus they ranged from about 100 to

300 years old in 1805 (fig. 8). The 1810 fire subsequently destroyed most of these stands, producing today's 185-year-old dominant trees.

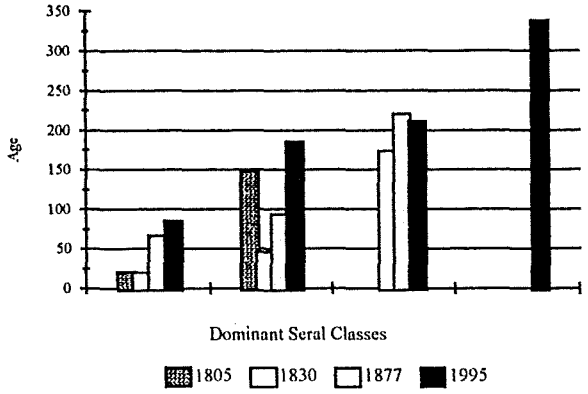
Fig. 8. Forest Age Classes by Period
Snowbank Camp



Cayuse Junction. The Lolo Trail quickly loses then regains nearly 1000 feet on either side of the saddle at Cayuse Junction, passing through a subalpine-montane forest ecotone. This area contains a diverse mix of cover types, and widely ranging stand ages. Dominant age classes today date to several fires between ca.1657 and 1784, as well as to 1910 and ca.1810. This combination of pronounced vertical relief, different stand types, and variable fire history must have made this one of the most challenging stretches of trail before 1900.

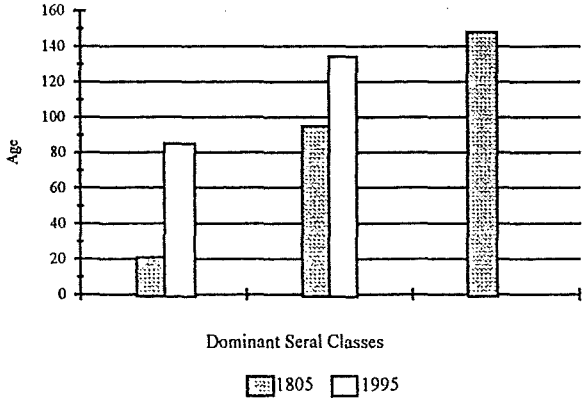
Age class diversity apparently increased markedly after 1805 (fig. 9). For example, because an extensive fire had occurred shortly before John Work's 1831 trip (i.e., ca.1810), major portions of the trail between Cayuse Junction and the Crooked Fork drainage were likely nearly impenetrable.

Fig. 9. Forest Age Classes by Period
Cayuse Jct.



Bears Oil and Roots. Lewis and Clark camped in this locale on June 27, 1806, after an exhausting 28 miles on the Lolo Trail. The fire history map suggests a predominant ca.1657 age class, but several others also may have occupied the area (e.g., ca.1710 and 1784). Thus the party apparently passed through 20- to 150 year old stands of lodgepole pine and mountain hemlock (fig. 10). Portions of these age classes subsequently were destroyed by fires in ca.1861 and 1910.

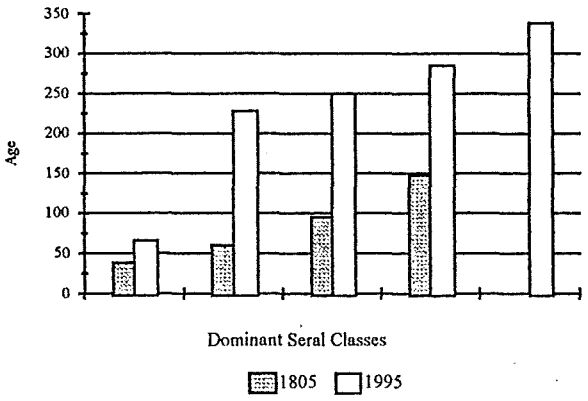
Fig. 10. Forest Age Classes by Period
Bears Oil & Roots



Indian Post Office/Lonesome Cove. This section of the trail corridor today contains numerous age classes, from fires in ca.1657, 1710, 1745, 1767, and 1929. The Lewis and Clark Expedition therefore had to struggle through at least 4 different age classes, ranging in age from just 40 years to 150 years or more (fig. 11). Worse, the party had to make their descent into the densely forested Moon Creek drainage during a soaking snowstorm:

> "... *I walked in front to keep the road and found great dificuelty in keeping it as maney places the Snow had entirely filled up the track, and obliged me to hunt Several minits for the track, ... I have been wet and as cold in every part as I ever was in my life, indeed I was at one time fearfull my feet would freeze in the thin Mockirsons which I wore, ...*" (DeVoto 1953: 239-240).

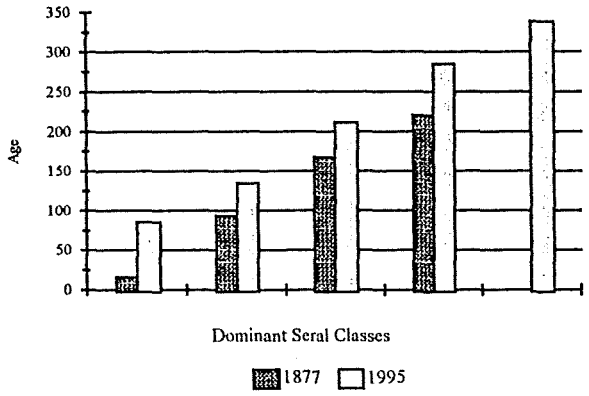
Fig. 11. Forest Age Classes by Period
Indian Post Office/Lonesome Cove



Howard Camp. The saddle at the head of Howard Creek has long served as a campsite along the Lolo Trail. (Scar dates on the area's numerous culturally peeled lodgepole pines range from ca.1790 to 1860). In 1877, General Howard's party used this site when he pursued Chief Joseph across the mountains. The area contains many age classes today: ca.1657, 1710, 1784, 1861, and 1910. Therefore as many as 4 classes, ranging from less than 20 years old to more than 200 years old, occupied the area in 1877 (fig. 12). As stated previously, the highly diverse mosaic that existed throughout the trail's length in 1877 may have been substantially

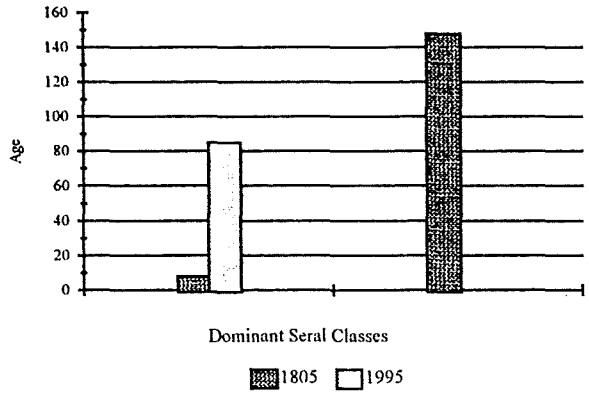
more difficult to penetrate than during 1805-06.

Fig. 12. Forest Age Classes by Period
Howard Camp



Sinque Hole/Smoking Place. The extensive 1910 age class now dominates the most westerly portion of the trail corridor in Powell, west of upper Gravey Creek. Near the Sinque Hole and Smoking Place, only a few highly scattered old trees and 1910 snags provide clues to earlier age classes. Several well-preserved snags from the ca.1657 class were sawn on the north side of the divide, whereas ca.1797 and 1835 remnants still were sampled on the south side, in upper Lost Creek basin. Thus in 1805 the area's lodgepole pine stands would have ranged from less than 10 years old to about 150 years old or more (fig. 13). However, because the ca.1657 age class apparently was widespread, the party probably was easily able to skirt the recent burn in ca.1797.

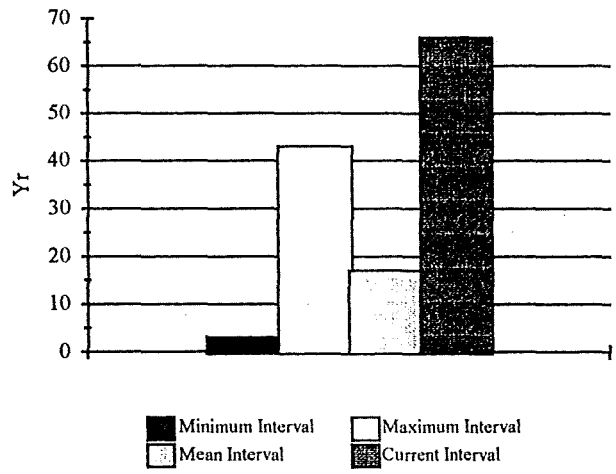
Fig. 13. Forest Age Classes by Period
Sinque Hole/Smoking Place



Implications for Ecosystem Management. To date, the CNF and adjacent national forests have obtained a considerable amount of fire history data (Barrett 1995), but usually for discrete local study areas such as drainages. Because the Lolo Trail sampling covered the full width of a ranger district, the data provide a unique perspective on fire's historical role and the effects of modern fire exclusion at the coarse scale. This information suggests the following implications for ecosystem management. First, 7 decades of increasingly effective fire suppression apparently have promoted mosaic homogeneity in unlogged subalpine areas of the trail corridor (fig. 14). Stand decadence caused by insects, diseases, and subsequent windthrow is now widespread in the subalpine zone-- where most lightning ignitions occur. Before 1929, average fire intervals in subalpine stands were about 150 years long, whereas longer fire intervals (e.g., 150-300+ yr) occurred in moist lower elevation stands (table 1). About half the

stands in the trail corridor currently are old growth, and another 15 percent would be classified as mature (e.g., 80-100 yr). Thus about two-thirds of the stands in the mosaic are approaching, or are well within, the range of past replacement intervals. Because most of the older stands occupy a relatively contiguous block between Papoose Saddle and Saddle Camp, major stand replacement burning may be imminent for this subalpine segment of the trail corridor.

Fig. 14. Area Fire Frequency
Lolo Trail Corridor, Powell R.D.



Stand-replacing fires represent the predominant severity type in Powell District, but patchy underburns also occasionally occurred along subalpine ridges and lower-elevation south slopes. Unscheduled- and manager-ignited fires during late fall might help thin some stands, but could temporarily increase fire hazards by accelerating the accumulation of dead fuels. Selective harvests and slash burning clearly would represent the most effective mitigation measure, at least near important cultural sites.

Table 1. Intervals between stand replacing fires near 15 historic sites along the Lolo Trail, Powell Ranger District, Clearwater National Forest. *Cover Types: LPP (lodgepole pine-whitebark pine), L (western larch), WRC (redcedar), S-F (spruce-subalpine fir), MH (mountain hemlock), MC (mixed conifer).*

			Fire Intervals by Forest Zone	
Plot No.	**Location**	**Cov. Type**	**Montane/Riparian**	**Subalpine**
1-2	Packer Meadows/Glade Cr. Camp	LP, L, S-F		177, 143, 113
39-40	21-Mile Camp	L, WRC, MC	223, 400	
35	Powell Junction	LP		116
12-13	Powell Island	L, WRC	300, 239	
14-15	Whitehouse Pond	WRC, L	223	
17	Wendover Ridge	L, LP, MC	100, 126	
26-28	Snowbank Camp	LP, MH		100
20-23	Cayuse Junction	LP, MH, MC		126
45-46	Bears Oil & Roots	LP, MH		204
49-51	Indian P.O./Lonesome Cove	LP, MH, MC		219, 184, 88, 53, 272
54-55	Howard Camp	LP, MH		126, 204, 200, 253, 77, 151
64-67	Sinque Hole/Smoking Place	LP		113, 75
Multiple-site average fire interval (MAFI):			**230**	**150**

Historical fire cycles and the age class map might serve as useful guides for selecting and scheduling stand treatments. For example, the study area contains about 11,000 acres of subalpine forest with a mean stand replacement interval of 150 years (table 1). Fires therefore recycled an average of about 75 acres of subalpine stands per year. Because 7 decades have passed without significant fires, about 5000 acres of subalpine forest--nearly half the total subalpine mosaic--might now be due for replacement. A fire cycle of about 230 years is suggested for the trail corridor's approximately 6400 acres of montane and riparian forest (table 1). Without timber harvests, this average of 28 burned acres per year would compute to about 2000 acres of potentially recyclable montane and riparian forest between 1930 and 1995. Consequently, as much as 40 percent of the total forest mosaic in the trail corridor might have been burned by post-1930 fires. To date, timber harvests have recycled about one-third of the mosaic--but largely in the montane forest zone. Management for ecosystem processes and recreation values thus logically would focus on today's decadent subalpine stands.

In view of northern Idaho's rather notorious fire history, this theoretical backlog of potentially recyclable stands could easily be surpassed during the next wildfire. And, even with relatively aggressive stand treatments, wildfires will continue to play a dominant role in shaping forests along the Lolo Trail. The important question is how modern management will influence this process.

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